

ABSTRACT

The present invention specifically relates to the methods and apparatus for heating a catalyst bed for start-up and for providing heat to a catalyst bed during transient operation to maintain desired reaction temperatures. An electrical heating element may directly or indirectly heat the catalyst. The direct heating of catalyst is achieved by having direct contact of the heater element with the catalyst. Indirect heating is achieved by direct heating of a fluid, such as a process flow, which in turn flows through the catalyst, thereby transferring heat to the catalyst. Additionally, indirect heating may be achieved by placing the heating element within a sheath that is then either in direct contact with the catalyst or fluid that flows through the catalyst. By these means, catalyst of many forms may employ this catalyst heater including pellets, extrudates, spheres, and monoliths. The catalyst heater in accordance with this invention can be made of any resistive wire, cartridges, or rods that may be coupled to a power source to provide the energy to produce the heat.